

SUMMARY OF STATE RADON PROGRAMS

Office of Radiation Programs
U.S. Environmental Protection Agency
and
Conference of Radiation Control
Program Directors

August 1987

ACKNOWLEDGMENTS

This report was prepared by the Environmental Protection Agency (EPA), Office of Radiation Programs, in Washington, D.C. and the Conference of Radiation Control Program Directors. Jamie Burnett of the Office of Radiation Programs coordinated this project. Technical support was provided by Putnam, Hayes & Bartlett, Inc., Washington, D.C. 20036.

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OBJECTIVES AND APPROACH

This report was prepared on behalf of the U.S. Environmental Protection Agency (EPA) in cooperation with the Conference of Radiation Control Program Directors (CRCPD) to provide a baseline of information on State indoor radon programs. While virtually every State has at least a small amount of radon program activity, programs vary from State to State. The objective of this report is to provide a means by which States can exchange information regarding the organization and administration of State radon programs, thereby assisting States in creating their own programs.

The report describes the range of State radon activities underway, the administrative and legislative mechanisms used to support these activities, and the resources devoted to them. The report focuses on the scope and magnitude of the radon program within each State, rather than on the radon problem and how to address it. Hence, the report is not a comprehensive source of technical information, nor a source of measurement or mitigation results.

State radon programs are naturally influenced strongly by geologic or measurement data that may indicate the potential for a problem, as well as by issues particular to each State (e.g., public concern, resource availability, the size and structure of existing radiation control programs, and legislative procedures). Although several States have initiated surveys, at this time, few States know for certain whether or where

elevated indoor radon levels will occur in the State. Consequently, many States must rely on available geologic information in order to assess the urgency of the problem. In this context of technical uncertainty, different financial capabilities, and different institutional structures, the wide variation from State to State in the level of radon program development is not surprising. Finally, the report focuses only on programs designed to address elevated levels of indoor radon from naturally occurring sources, although it is clear that significant State capabilities have sometimes been developed in response to other radiation problems.

INFORMATION SOURCES AND QUESTIONS

Information regarding each State radon program was assembled from existing data collected by EPA Headquarters and by EPA regional radiation program representatives. This information was expanded through discussions with a knowledgeable government representative in each State (generally in the lead agency). In a few cases, discussions involved several State representatives at the suggestion of the first State contact. Finally, the information was verified by the CRCPD representative of each State.

This report describes State radon programs as of July 1, 1987. However, the radon program in several States is changing rapidly due to new information (e.g., survey results) and legislative development. In a few exceptional cases, particularly important developments during July and August 1987 were also included in the report.

In the detailed description of each State's program (provided in the Appendix), a State contact (or contacts) is identified as a source of further information and that person's address and telephone number are indicated. We have attempted to verify the information with each State as fully as possible. Nevertheless, it is possible that some program activities have

occasionally been missed (especially those activities which are administered outside of the lead agency). As a whole, the descriptions should provide a useful indication of the scope of each State program and the organization which administers it.

Questions relating to a specific State (i.e., the Appendix descriptions) should be directed to the State contact. Questions regarding this summary report should be directed to:

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SUMMARY OF EPA ACTIVITIES

Since many States are already receiving some EPA assistance in developing a radon program, it is useful to review the four major elements of EPA's Radon Action Program: (1) Problem Assessment; (2) Mitigation and Prevention; (3) Capability Development; and (4) Public Information.

With respect to Problem Assessment, EPA has developed a program (the EPA State Radon Survey Program) to help States conduct State-wide statistically designed radon surveys. EPA provides survey design assistance and measurement devices (charcoal canisters). The design work includes a preliminary geologic characterization to identify areas with a high likelihood of elevated measurements. Ten States participated in the program in fiscal year 1987 (FY 87) and seven States have submitted applications for FY 88. In addition, EPA is designing a national survey to meet the national indoor radon assessment requirement contained in the Superfund Amendments and Reauthorization Act (SARA).

Also as part of its Problem Assessment program, EPA issued standardized measurement protocols for seven measurement methods. These protocols help to ensure that measurements are comparable and to assure the public that readings are made accurately. States must follow the protocols in the EPA/State survey. EPA is also beginning to identify those geological factors and characteristics which are most useful as indicators of high radon levels. EPA is conducting preliminary work on the use of soil gas measurements to predict the radon potential for individual parcels of land.

Under Mitigation and Prevention, EPA's Office of Radiation Programs (ORP) is conducting the House Evaluation Program (HEP), which is designed to assist the States in providing home evaluations and mitigation recommendations. Eighty homes in Pennsylvania were evaluated under Phase I of HEP; Phase II will tentatively cover an additional 80 homes in more than five other States. EPA's Office of Research and Development (ORD) is also conducting a Mitigation Demonstration Program. Demonstrations are underway in New Jersey, New York, and Pennsylvania, and additional projects are planned in Maryland.

Under Capability Development, EPA's activity includes two major programs, one on diagnostic and mitigation training and the other on measurement proficiency. The Mitigation Training program is designed for State personnel and private contractors chosen by the States. Twenty-seven courses have been completed and 1,000 people in 40 States have been trained. The Radon Measurement Proficiency Program (RMP) is designed to test the ability of radon measurement firms to measure accurately the radon concentration in a control chamber with a radon level known to EPA. Approximately 150 firms have demonstrated adequate proficiency (based on the results for participants in the third round of the program) and were listed in the last semiannual RMP Report.

Under Public Information, EPA has developed several brochures and publications for distribution to homeowners or contractors. These include two brochures for homeowners: "A Citizen's Guide to Radon: What It is

and What To Do About It" ("A Citizen's Guide"), and "Radon Reduction Methods: A Homeowner's Guide" ("Radon Reduction Methods"). EPA also developed a technical manual for use by contractors and interested homeowners: "Radon Reduction Techniques for Detached Houses: Technical Guidance" ("Technical Guidance"). States were provided with camera-ready copies of the two brochures for reprinting and distribution, as well as copies of the "Technical Guidance." States also distribute EPA's RMP Report, or a list of firms operating within the State that is extracted from the RMP Report.

ORGANIZATION OF REPORT

In order to facilitate a comparison of programs across States, the principal descriptive characteristics of each program have been grouped into six areas:

1. Program Organization and Administration;
2. Measurement Activities;
3. Mitigation Activities;
4. Health Risk Studies;
5. Geology/Land Evaluation Studies; and
6. Public Information Activities.

Each of the six areas is characterized quantitatively whenever possible (e.g., dollar budget, number of measurements, number of information brochures distributed, etc.). These quantitative measures provide only a partial description of each State's activities, as is evident through examination of the detailed description provided for each State in the Appendix. To complete the comparison, State activities are also summarized along other dimensions, recognizing that the summary may necessarily simplify activities that are individually extensive within a given State.

This report is organized in three sections. Chapter 2 provides an overview of the origin and emphasis of various State programs. The purpose of this section is to place in context variations in the level of activity from one State to the next and the different choices States have made in implementing their programs. Four general levels of program development are described in order to facilitate program comparisons. In each of the six descriptive areas mentioned above, Chapter 3 compares specific activities across States, both to provide a sense of the overall level and range of activities, and to highlight important elements that are common to many programs. Finally, Chapter 4 summarizes some of the key observations, highlights concerns that are common to more than one State, and notes initial trends in State programs. As mentioned earlier, a detailed description of the radon program in each State is provided as an Appendix.

The heart of this report is the summary of specific State activities drawn from the descriptions of individual programs. However, there are some general observations we can make concerning the origin of State radon programs and the approach taken by States in developing their programs. These observations provide a perspective for the comparisons that follow.

ORIGIN OF STATE PROGRAMS

The States fall into relatively distinct levels of development, but within those levels, radon programs are quite different. Among the reasons for these differences are the factors contributing to their origins. For example, western States that have uranium mining learned about radon and its health risks in the 1950s and 1960s when studies showed a high incidence of lung cancer among uranium miners. Together with the federal government, these States developed programs to assist citizens living on or near uranium mines or mill tailings sites. In 1978, Congress passed the Uranium Mill Tailings Radiation Control Act, and in 1983, EPA promulgated health standards for these areas. In order to estimate recoverable uranium ore reserves, the U.S. Geological Survey and the Department of Energy gathered extensive data to map the presence of uranium in the soil and underlying rock. Since most of the significant U.S. uranium deposits are in the west, these geologic data have proven valuable in determining potential "hot spots" for radon in homes. In the late 1960s, it was also discovered that uranium mill tailings had been removed from waste sites and used as construction materials, particularly in Grand Junction, Colorado.

In 1970, the Surgeon General of the U.S. Public Health Service issued health guidelines for Grand Junction which are now being implemented by the State of Colorado and the U.S. Department of Energy (DOE).

Although few western States have operational indoor radon programs, many of these States have the benefit of existing data and an understanding of applicable measurement techniques developed for these other programs to assess the potential for an indoor radon problem. For example, in 1977, the Montana Department of Health and Environmental Sciences (DHES) initiated an investigation of the use of phosphate slag in Butte and Anaconda, Montana. Phosphate slag, a waste product from a nearby elemental phosphorus smelter, was of concern because of its elevated content of natural radioactivity, particularly radium-226. During the investigation of phosphate slag, DHES discovered elevated radon and radon decay product concentrations in many structures in Butte. DHES requested assistance from the U.S. Environmental Protection Agency (EPA). The EPA's Office of Radiation Programs subsequently entered into a contract with DHES to identify the sources of radon in structures and in the ambient air in the Butte area. The scope of the contract was expanded in 1981 to include an intensive sampling program designed to evaluate the state-of-the-art in indoor radon measurement equipment and methods. During 1977, an EPA gamma survey truck operated by EPA and the Idaho Radiation Control office scanned the towns of Soda Springs and Pocatello, Idaho, to detect elevated radiation levels coming from phosphate slag used within structures.

State radon programs in the east developed under different circumstances. The 1984 discovery of highly elevated radon levels in homes on the geologic formation known as the Reading Prong prompted Pennsylvania, New York, and New Jersey to develop their radon programs fairly quickly. Because a large number of homes were discovered to have elevated radon levels, these States have devoted substantial resources to addressing radon and related issues. Yet different factors influenced the development of programs in Maine, where radon in well water is a particular

issue, and in Florida, where elevated radon levels in homes built on reclaimed phosphate mining lands were investigated by Florida and EPA in the 1970s.

Except for Florida, the southeastern States are developing radon programs but are generally less active than States in the northeast. Several States have chosen to move slowly because the available geologic data on the soil in this area typically do not indicate an obvious potential to create a radon problem. Limited surveys have not discovered levels similar to those found in the Reading Prong, although several States have found homes with elevated levels. Several southeastern States mentioned that national attention to the radon issue was the impetus for their program.

Some State programs have also been strongly influenced by prior State or federal energy conservation efforts. For example, in Oregon, Washington, and Idaho, DOE's Bonneville Power Administration (BPA) has sponsored extensive testing and studies on indoor radon, and on the effects of weatherization on indoor air quality. States have utilized this information in determining the structure and emphasis of their radon programs. In a few States, the association of energy work and indoor air quality has facilitated the use of funds distributed to the States pursuant to oil overcharge litigation for radon-related programs (e.g., in Connecticut, Iowa, New Hampshire and New York).

These are only a few of the many factors that have influenced the pace of radon program development. Other factors include the availability of resources, the structure of State governments (yearly or biennial legislatures, division of responsibilities among State agencies), public concern and/or media activities, and the perceived risks of radon in comparison to other environmental concerns in a State.

PROGRAM EMPHASIS AND LEVEL OF DEVELOPMENT

Essentially all States have some mechanism for handling indoor radon

problems, whether it is formal by legislative mandate or informal under general public health policy. While it is difficult to categorize the different approaches taken by the States since the programs vary along many dimensions, we can make observations as to the general levels of activity. To facilitate discussion, we have placed State programs into one of four categories, depending on the extent of the problem as perceived by the State and its response to date:

LEVEL 1. INFORMATION PROGRAM: States at this level are not actively addressing radon issues. Very little State time is spent addressing inquiries. Normally, the State distributes EPA information documents to homeowners upon request and monitors activities in other States. Very few, if any, State measurements have been taken.

LEVEL 2. FORMATIVE PROGRAM: States at this level are actively beginning to address radon issues, but have not begun extensive testing. These States are providing information to homeowners and other interested parties, distributing EPA documents upon request, and are sometimes developing State materials. These States are performing limited measurements (screening only, follow-up only, or both), and are collecting data from measurement firms. A few are preparing for or considering extensive surveys.

LEVEL 3. DEVELOPING PROGRAM: The key to this level is extensive state-wide testing. All of these States have state-wide surveys underway or recently completed. A few States are performing measurements with appropriated radon funds; others are drawing on general funds in the department. Several of these States are participating in EPA's State Radon Survey Program. Three States have active information programs which include reprinting and distribution of EPA materials. A few have specific legislation and several have task forces that involve multiple State agencies and/or non-governmental groups.

LEVEL 4. OPERATIONAL PROGRAM: The key to this level is that a radon problem has been reasonably confirmed, and the States are moving to address it. All have funding for radon programs, often with specific legislative mandate. All have or had task forces. These States have each sponsored several thousand or more tests, and a few provide financial assistance to homeowners for measurements and/or mitigation. In a few cases, funding is provided for health risk studies and geological surveying. Private radon mitigation or prevention is underway in over 50 homes per State. Extensive information and training programs are in operation.

The four levels described above represent very general stages of program development. Most of the States fall into Levels 1 or 2 (Information Programs or Formative Programs), while only five have Operational Programs (Level 4). Due to the many activities included in radon programs, the boundaries between development levels is not well defined. Rather, States were assigned to a level in order to facilitate discussion, based on broad differences in the level of activity. With these qualifications in mind, Table 1 presents an overview of the current level of State radon program development. Seven States have Information Programs (Level 1), 24 have Formative Programs (Level 2), 14 have Developing Programs (Level 3), and five have Operational Programs (Level 4). The geographic location of these States is illustrated in Figure 1. Since the potential for a radon problem is related to geologic features that extend across State boundaries, it is logical to expect that neighboring States will face similar issues. It is, therefore, also to be expected that the level of radon program development tends to be similar for States in the same geographic region, as shown in Figure 1.

In addition to being at varying levels of development, radon programs also differ in emphasis. While most States indicated a desire first to survey the State to determine the extent of the problem, a few indicate a preference for first adopting rules and regulations to certify measurement and

mitigation companies in order to prevent homeowners from performing unnecessary measurements or repairs. A few States have been able to move forward with existing general funds, while many are constrained until specific funding becomes available. A few States mentioned that the emphasis of their programs was strictly to disseminate information. For the five States with Operational Programs, the emphasis has turned toward locating homes at risk and developing and assisting mitigation or prevention efforts. In Florida, the current emphasis is on radon prevention in new homes, while in Maine, the focus is on radon in water^{*}. The remaining three Operational Programs (New Jersey, New York, Pennsylvania) were developed largely in response to the discovery of elevated indoor radon levels in existing homes on the Reading Prong.

* Although Maine's program is Operational with respect to radon in water, it is still Developing for radon in air.

Table 1
CURRENT LEVEL OF
STATE RADON PROGRAM DEVELOPMENT

LEVEL 1: INFORMATION PROGRAM

Arkansas	Mississippi	South Dakota
Hawaii	Nevada	Texas
Louisiana		

LEVEL 2: FORMATIVE PROGRAM

Alaska	Iowa	New Hampshire	Oregon
Arizona	Massachusetts	New Mexico	South Carolina
California	Minnesota	North Carolina	Utah
Delaware	Missouri	North Dakota	Vermont
Georgia	Montana	Ohio	Washington
Idaho	Nebraska	Oklahoma	West Virginia

LEVEL 3: DEVELOPING PROGRAM

Alabama	Indiana	Michigan	Wisconsin
Colorado	Kansas	Rhode Island	Wyoming
Connecticut	Kentucky	Tennessee	
Illinois	Maryland	Virginia	

LEVEL 4: OPERATIONAL PROGRAM

Florida	New York
Maine*	Pennsylvania
New Jersey	

SOURCE: Putnam, Hayes & Bartlett, Inc., 28 August 1987.

*
Maine's program is Operational for radon in water, but is Developing for radon in air.

Figure 1

CURRENT LEVEL OF STATE RADON PROGRAM DEVELOPMENT



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This section summarizes and compares State radon programs within each of six general areas:

1. Program Organization and Administration;
2. Measurement Activities;
3. Mitigation Activities;
4. Health Risk Studies;
5. Geology/Land Evaluation Studies; and
6. Public Information Activities.

Each area is discussed below.

PROGRAM ORGANIZATION AND ADMINISTRATION

Even at the Formative Program level, implementation of a radon program involves resolution of a number of basic organizational issues, including: (1) designation of a responsible agency or group(s) within the State to lead the program, (2) identification and organization of other groups that have a role in addressing the problem, (3) a mandate -- executive, legislative, or otherwise -- to address the problem, (4) resources to develop the program, and (5) a strategy to address the problem. Moreover, even before a program is organized, the State must determine the degree to which it should implement a program, in response to its perception of the need for a program. To determine this need initially, the State must collect and review available measurement and geologic data.

The seven States at the Information Program level (Level 1) do not presently perceive the need to create a program, do not have a clear mandate to develop one, and/or do not have the resources to develop one. As a result, they tend to rely heavily on EPA and other federal assistance in order to supply citizens with information. A lead agency (normally a group that handles other environmental radiation matters within the State) is typically not designated in a formal way, but rather addresses radon issues along with other responsibilities. The strategy of these States for addressing the radon problem is implicit in broader radiation protection goals, and specific policy decisions are confined to endorsement of EPA or other federal guidance (e.g., EPA's Action Level guidance as contained in "A Citizen's Guide to Radon"). Citizen awareness is low, and program development beyond this level depends heavily on evidence that a problem could exist and the availability of resources.

The 24 States at the Formative Program level (Level 2) generally acknowledge that a problem within their States could exist (either as a result of limited measurements, historical awareness for other reasons, or geologic data), and are considering or will soon begin active program development. While a lead agency is typically not yet formally designated, a more active role is emerging for personnel within the agency that handles radiation issues. With a few exceptions, one person spends the equivalent of one-quarter to full time working on radon in these 24 States (Missouri, Oklahoma and Oregon devote less time; Massachusetts and Ohio devote more time). Five of these States (Arizona, California, Iowa, New Hampshire, and Utah) have limited funding for measurements in FY 88; Washington had funding in FY 86 and FY 87, but not in FY 88. Delaware and Nebraska have had general radiation control regulations in place for several years that incidentally require certification of indoor radon measurement companies (Nebraska's recent legislation will also require certification of radon mitigation companies).

The 14 States at the Developing Program level (Level 3) devote one or more person fulltime to radon, except for Rhode Island and Colorado (both of which are in EPA's State Radon Survey Program). Four have three or more fulltime equivalent employees on radon and more than \$75,000 in radon-specific appropriations (Alabama, Connecticut, Illinois, and Tennessee). Wisconsin also has limited funding (\$25,000 for measurements, in FY 87). Nine of the 14 States (Colorado, Connecticut, Illinois, Kansas, Maryland, Michigan, Tennessee, Virginia, and Wisconsin) have created radon task forces to study the problem; six of the nine task forces include non-government representatives.

The five States which have Operational Programs (Level 4) include both the Reading Prong States (New Jersey, New York, and Pennsylvania) and two other States with acknowledged radon problems (radon in water in Maine; phosphate lands in Florida). Task forces have been used or are proposed in all five States; three of the task forces include non-governmental representatives. All but Maine have radon-specific legislation in place Maine has recently created a study commission on radon that, among other tasks, will submit legislative recommendations to the Maine Legislature by January 15, 1988. In all cases except Maine, existing legislation also defines roles for a specific agency or agencies. The Reading Prong States have funding or appropriations in excess of \$4.3 million each, and 19 or more fulltime equivalent employees are devoted to radon work. Florida has a survey appropriation of \$1 million and devotes about 2.5 fulltime equivalent employees. While Maine's indoor radon in air program is less extensive than the other four and is still at the Developing Program level, it has initiated significant study of radon in water and has an Operational Program for this problem. Maine devotes about 3.5 fulltime equivalent employees to radon work.

Tables 2 and 3 summarize all 50 State programs with respect to organization and resources and legislative activity, respectively. In total, nearly \$20 million in funding has been specifically appropriated to radon, and approximately 119 fulltime equivalent employees are working on indoor radon

Table 2
ORGANIZATION AND RESOURCES

STATE	PROGRAM ADMINISTRATION	TASK FORCE			RADON SPECIFIC APPROPRIATION		RADON FULL-TIME EQUIVALENT EMPLOYEES
		Source of Formal Designation	Status	Type of Membership	Amount (\$ 000's)	Time period for expenditure	
	Lead Agency (s):						
Alabama	Dept. of Public Health				\$75	FY87	3
Alaska	Dept. of Health & Soc. Svcs.				--		0.25
Arizona	Radiation Regulation Agency				\$58	FY88	1
Arkansas	Dept. of Health				--		<.01
California	Dept. of Health Services				\$109	FY 88,89	0.75
Colorado	Dept. of Health		Current	Interagency	--		0.25
Connecticut	Dept. of Health Services	Governor	Current	Govt/non-govt	\$400	FY88	5.5
Delaware	Dept. of Health & Soc. Svcs.				\$10	FY88	0.3
Florida	Dept. of Health & Rehab. Sv.	Legislation	Current	Govt/non-govt	\$1,000	18 month survey	2.5
Georgia	Dept. of Natural Resources				--		1
Hawaii	Dept. of Health				--		<.01
Idaho	(1) Dept. of Health & Welfare		Current	Ad Hoc Comm.	--		0.50
(shared lead)	(2) Dept. of Water Resources			(Interagency)			0.1
Illinois	Dept. of Nuclear Safety		Past(1986)	Interagency	\$130	FY88 (Pending)	3.25
Indiana	State Board of Health				--		2.5
Iowa	Dept. of Public Health		Current	Govt/non-govt	\$123	FY88	1
Kansas	Dept. of Health & Environment		Current	Govt/non-govt	--		1
Kentucky	Dept. of Health Services				--		2
Louisiana	Dept. of Environmental Quality				--		0.1
Maine	Dept. of Human Services		Current	Govt/non-govt	--		3.5
Maryland	Dept. of the Environment		Current	Govt/non-govt	--		2
Massachusetts	Dept. of Public Health				--		1.5
Michigan	Dept. of Public Health		Current	Govt/non-govt	--		1.5
Minnesota	Dept. of Health		Current	Govt/non-govt	--		0.5
Mississippi	Dept. of Health				--		<.01
Missouri	Dept. of Health				--		0.1
Montana	Dept. of Health & Env. Sciences				--		0.25
Nebraska	Dept. of Health				--		0.25
Nevada	Dept. of Human Resources				--		<.01
New Hampshire	Dept. of Health and Human Serv.	Governor	Current	Interagency	\$105	18 month survey	1
New Jersey	Dept. of Env. Protection	Legislation	As Needed	Varies	\$4,340	FY87	26
New Mexico	Dept. of Health & Environment				--		1.5
New York	(1) Dept. of Health	Legislation	Current	Interagency	\$5,675	FY87	15
(shared lead)	(2) State Energy Office	Legislation			\$1,025	3 yrs or more	3
	(3) NYS Energy Res. & Dev. Auth.				\$1,167	Indefinite	1
North Carolina	Dept. of Human Resources				--		NA
North Dakota	Dept. of Health				--		1
Ohio	Dept. of Health				--		1.5
Oklahoma	Dept. of Health				--		0.125
Oregon	Dept. of Human Resources				--		0.05
Pennsylvania	Dept. of Environ. Resources	Legislation	Current	Govt/non-govt	\$5,300	FY87 or longer	21
Rhode Island	Dept. of Health				--		0.33
South Carolina	Dept. of Health & Env. Control		Current	Govt/non-govt	--		0.5
South Dakota	Dept. of Water & Nat. Resources				--		0.5
Tennessee	Dept. of Health and Environment		Current	Govt/non-govt	\$150	FY88	3
Texas	Dept. of Health				--		0.0625
Utah	Dept. of Health				\$38	FY88	0.5
Vermont	Dept. of Health		Current	Intra-agency	--		0.25
Virginia	Dept. of Health		Current	Govt/non-govt	--		2.5
Washington	Dept. of Social & Health Svc.				\$50	FY87	1
West Virginia	Dept. of Health				--		0.4
Wisconsin	Dept. of Health & Soc. Services		Current	Interagency	\$25	FY87	2.25
Wyoming	Dept. of Health & Med. Services				--		2
TOTAL					\$19,780		119.1

KEY

Blank =
Informal
Lead

Blank =
No Task
Force

Interagency =
State govt.
membership
only

Dash = No
Specific
Appropriation

FY =
Fiscal Year

NA =
Not Avail.

SOURCE: Putnam, Hayes & Bartlett, Inc., August 28, 1987.

Table 3
LEGISLATIVE INITIATIVES

STATE	LEGISLATION ENACTED			LEGISLATION PROPOSED		
	Reference	Summary of Legislation	Effective Date	Reference	Summary of Legislation	Status
Alabama						
Alaska						
Arizona						
Arkansas						
California				AB 31; SB 127	Budget appropriation (survey)	Pending
Colorado						
Connecticut				NA	Cert. of measurement firms	Failed
Delaware	Section B(5) SR 14	DE Radiation Control Regulations Radon study resolution	1983 1987			
Florida	Ch. 404.056 NA	Land Radiation Emission Standards 1986 Appropriations Act: budgets \$1 million for radon survey	1984 1986	NA	Cert. of measurement firms	Failed
Georgia						
Hawaii						
Idaho						
Illinois				NA	Budget approp. (survey & studies)	Pending
Indiana						
Iowa						
Kansas	HCR 5007	Creation of task force	4/87	HB 2079	Cert. of meas. and mitig. firms	Pending
Kentucky						
Louisiana						
Maine	LD 1023	Creation of task force	1987	LD 563	State testing of schools	Failed
Maryland	HJR 24	Creation of task force & survey	1987	NA	Certification and related legis.	Failed
Massachusetts						
Michigan						
Minnesota						
Mississippi						
Missouri						
Montana						
Nebraska	LB 390	Revisions to the Radiation Control Act call for develop. of Rn prog.; strengthening of current cert. regs.; req. mitig. contractors to submit copy of proposal to state.	5/87			
Nevada						
New Hampshire						
New Jersey	AB 4112 SB 1797	Budget approp. (survey & studies) Cert. of meas. and mitig. firms; mandatory reporting of results	1/86 8/86	AB 2940	Income tax deduct. for mitigation	Pending
New Mexico						
New York	Ch. 645 of State Laws SB 6496; AB 8594	Mandate studies on radon-related issues Appropriation of stripper well funds	1986 7/87	SB 4516,4338 AB 6363,6311	Subsidized mitigation financing; free testing/training; and miti- gation education & research	All 4 are pending
North Carolina	Ch. 50, 87 laws					
North Dakota						
Ohio						
Oklahoma						
Oregon						
Pennsylvania	NA	Radon Gas Demonstration Project and Home Improvement Act	1986			
Rhode Island	SB 137	Cert. of meas. and mitig. firms	7/87			
South Carolina						
South Dakota						
Tennessee	NA	Creation of task force; survey	1987			
Texas						
Utah						
Vermont						
Virginia	HJR 229	Creation of task force	2/87			
Washington						
West Virginia						
Wisconsin						
Wyoming						
KEY	Blank = No legislation Enacted/Proposed HCR = House Concurrent Resolution HJR = House Joint Resolution			LB = Legislative Bill AB = Assembly Bill SB = Senate Bill SR = Senate Resolution		
				LD = Legislative Directive HB = House Bill NA = Not Available		

SOURCE: Putnam, Hayes & Bartlett, Inc., August 28, 1987.

in the 50 States. However, the three Reading Prong States account for 88.5 percent of the funding and 55.1 percent of the fulltime equivalent employees. Based on Tables 2 and 3, a number of additional observations can be made to characterize the organization and administration of State radon programs, as follows:

- All but eight States administer their radon programs out of the Department of Health or its equivalent (the exceptions are Arizona, Georgia, Illinois, Louisiana, Maryland, New Jersey, Pennsylvania, South Dakota). Alternative lead agencies are either the Department of Environmental Protection (or equivalent) or a radiation-specific agency. The lead agency designation does not appear to affect program development. Only two States (Idaho and New York) have a shared lead.
- Twenty States had, have, or plan to have task forces. Of these 20 task forces, 12 include non-state government membership, such as local government representatives, measurement or mitigation company members, citizen and/or environmental group members, and academia. All 12 of these government/non-government task forces are currently active. Of the remaining eight, two are "Ad Hoc" or "as needed" (Idaho, New Jersey), one is disbanded (Illinois, previously interagency), Vermont's is intraagency and the rest are currently active, interagency task forces.
- In the cases where legal requirements are in effect (e.g., mandatory certification), they are generally specified in legislation rather than through regulation pursuant to existing statutes. Exceptions include New York (regulations under development) and Florida (regulations will specify the geographic areas in which a legislated 0.02 WL building standard will be applied).

MEASUREMENT ACTIVITIES

Since the extent of the radon problem in States is still unclear, measurement and associated activities constitute one of the key parts of current radon programs. Measurement activities range from no activity or isolated measurements by State personnel to extensive state-wide surveys, both random (to characterize the distribution of radon levels within the State) and "hot spot" or focused surveys to locate specific houses with elevated levels in geographic areas suspected to have a high radon potential. In addition to measurement itself, a number of activities associated with measurement are included in this discussion of State measurement programs, including provision of free or subsidized radon detectors, a program for monitoring screening measurements, follow-up if the measurement is above a certain level, collection of private measurement data, and organization of the measurement data in a computer database (which typically prompts important policy decisions with respect to data access). Current State measurement activities are summarized in Tables 4, 5, 6, and 7, which cover EPA/State surveys (Table 4), State surveys (Table 5), local surveys (Table 6), and associated measurement activities (Table 7).

None of the seven Information Programs (Level 1 States) have performed radon measurements or have initiated significant other measurement activities. Four of the seven States (Arkansas, Hawaii, Louisiana, and Texas) have received and reviewed data from Terradex, the University of Pittsburgh, or both. Louisiana is considering a very small future survey, and a Biloxi TV station in Mississippi has surveyed about 240 homes. About 20 volunteer homes in Pierre and Rapid City, South Dakota have also been tested. In general, none of these seven States anticipate (or have found) that a problem is present and, therefore, they have no plans to develop a significant program.

All of the 24 Formative Programs (Level 2 States) have had a limited amount of testing performed, although the tests in Arizona, Massachusetts,

Table 4
EPA/STATE SPONSORED SURVEYS

STATE	EPA STATE RADON SURVEY PROGRAM		OTHER EPA/STATE SURVEYS		
	Date	Number of Houses Measured (see Note)	Description	Date	Number Already Tested
Alabama	FY87	2200			
Alaska					
Arizona	Proposed FY88				
Arkansas					
California					
Colorado	FY87	900			
Connecticut	FY87	1600			
Delaware					
Florida			Reclaimed phosphate land	1978	1000
Georgia					
Hawaii					
Idaho					
Illinois					
Indiana	Proposed FY88				
Iowa					
Kansas	FY87	1000	Cherokee Cnty (11 buildings & 10 homes tested)	August 1985	21
Kentucky	FY87	900			
Louisiana					
Maine					
Maryland					
Massachusetts	Proposed FY88				
Michigan	FY87	500			
Minnesota	Proposed FY88				
Mississippi					
Missouri	Proposed FY88				
Montana			Helena Valley; EPA supplied 100 charcoal canisters	In Progress	250
			Butte	1979-1983	100
			Hot spot, grab sample	Completed	120
Nebraska					
Nevada					
New Hampshire					
New Jersey			Prescreen for mit. proj.	In Progress	NA
New Mexico					
New York			Prescreen for mit. proj.	In Progress	430
North Carolina					
North Dakota	Proposed FY88				
Ohio					
Oklahoma					
Oregon					
Pennsylvania	Proposed FY88				
Rhode Island	FY87	190			
South Carolina					
South Dakota					
Tennessee	FY87	1800	Uran. mill tailings(EPA)	late 70's	NA
Texas					
Utah					
Vermont					
Virginia					
Washington					
West Virginia					
Wisconsin	FY87	1700			
Wyoming	FY87	900			
TOTAL		11,690			1,921

NOTE: These are EPA estimates as of July 1987, and may conflict with numbers reported earlier by States.

NA =
Not Available

SOURCE: Putnam, Hayes & Bartlett, Inc., August 28, 1987.

Table 5
STATE TESTING PROGRAMS

STATE	DESCRIPTION OF PROGRAM (See Note)	DATE/STATUS OF PROGRAM	NUMBER OF HOUSES MEASURED
Alabama	Hot spot, AT	1985	19
Alaska	State is selling detector at cost	Began 1985	300
Arizona			
Arkansas			
California	State-wide random AT; 400 homes	Proposed FY88	0
Colorado			
Connecticut	CC; 4000 homes selected by geology, 220 potential hot spots; also 260 wells	Summer 1987	NA
Delaware	100 hour RPISU, on request	1985-1986	220
Florida	Random, AT and CC; includes 70 schools	In Progress	65
Georgia	Homes in 30 counties, CC	In Progress	7000
Hawaii		Winter 1986-87	88
Idaho	Hot spot, 20 tests per county, 50 counties		
Illinois	Random, 1 month AT; 3500-4000 planned	Winters 85-87	1000
Indiana	AT and CC; 3000 tests planned	In Progress	2000
Iowa	DOC, weatherization study; 200 planned	In Progress	1000
Kansas	Eastern part of state; CC	Fall 1987	0
Kentucky		Oct. 1986	100
Louisiana	Very limited study proposed		
Maine	CC; At cost testing program	Proposed FY88	0
	Water; At cost testing program	In Progress	1260
	Comprehensive state survey	In Progress	4560
Maryland		Proposed	0
Massachusetts			
Michigan			
Minnesota	Minnesota OSHA tests for workers		
Mississippi		In Progress	5
Missouri	Description not available		
Montana		In Progress	140
Nebraska			
Nevada			
New Hampshire	18 month survey; planned		
New Jersey	State wide random survey, CC; including 180 public buildings	Begin fall '87	0
New Mexico	50 volunteer ea. commun.; WLM 24 hr grab	12/86-6/87	6000
New York	Indoor Air Qual study; 1 yr living level AT		
North Carolina	State-wide random CC	In Progress	250
	Hot spot; AT	1986	2401
North Dakota	WLM follow-up tests	Winter 1986	500
Ohio	State selected, AT; plan 100-500	1986	35
	Regional Air Poll Control Agency (RAPCA) in the Dayton area	1985-present	100
Oklahoma			60
Oregon	AT in selected homes	2/86-9/86	160
Pennsylvania	Reading Prong, AT;		
	Colebrookdale, 5 minute Kusnetz and AT;	1985-1986	50
	Schools (175 in Reading Prong)	10/85-12/86	21800
Rhode Island		Nov. 1985	2800
South Carolina	AT and CC	In Progress	200
South Dakota	Volunteers in Pierre and Rapid City		
Tennessee		In Progress	300
Texas		NA	20
Utah	Hot spot		
Vermont	Hot spot; throughout state	Fall 1987	0
Virginia	State employee volunteers, WLM	1984	30
Washington		Spring 1987	800
West Virginia	Selected by state, RPISU		
Wisconsin		In Progress	12
Wyoming			
TOTAL			53,275

KEY AT = alpha track
CC = charcoal canister
RPISU = radon progeny integrating sampling unit
WLM = Working Level Monitor
NA = Not Available

NOTE: In several cases, State-sponsored programs received some EPA assistance.

SOURCE: Putnam, Hayes & Bartlett, Inc., August 28, 1987.

Table 6
LOCAL MEASUREMENTS AND FREE STATE TESTS

STATE	OTHER GOVERNMENT OR PRIVATELY SPONSORED TESTING PROGRAMS AND SURVEYS			FREE/SUBSIDIZED TESTING BY STATE (Exclud. EPA/State Survey)	
	Program Sponsor	Description of Program	Date/Status of Program	Number Already Tested	Description of Program
Alabama					Prev. free; now at cost
Alaska					
Arizona	Pima County DOH	Tucson area	Completed	35	
Arkansas					
California	LA County DHS & Found. Advanced Sci & Env LA Times	Random in LA; 3 month AT 1 year; employee homes	In Progress In Progress	100 600	RPISU on request Providing AT to some counties (request)
Colorado	City of Fort Collins	AT; in Fort Collins	In Progress	100	
Connecticut					
Delaware					
Florida					Free survey det., by request
Georgia					
Hawaii					
Idaho	BPA (DOE)	Weatherization program homes	In Progress	750	
Illinois	TV station & other groups	Chicago area	1986	200	At cost air (CC) or water
Indiana	Marian County	Subsidized detector distrib.	In Progress	NA	
Iowa	Scott County	Local homes	In Progress	200	
	ISU Extension Serv.	CC; random	In Progress	900	
Kansas	Wichita	Local homes	Completed	50	No (prev. Washtenaw cnty at cost)
	Washburn Univ.	Shawnee County homes	Winter 1986	70	
Kentucky	Private hospital	Bowling Green; CC	Winter 1986	500	
Louisiana					
Maine	State & Univ. Maine	RDP on water filters	Summer 1987	0	Free to Reading Prong At cost w/energy audit
	Cit. Against Nucl. Trash	Proposed; CC; 55 planned	Proposed	0	
Maryland					
Massachusetts	TV station	Boston area	11/86-2/11	200	
Michigan					CC at cost; free AT & CC to energy conservation program participants
Minnesota	TV station; Twin Cities	Twin Cities	Completed	200	
	St. John's Univ.	Edge of Canadian Shield	1985 (air)	54	
	St. John's Univ.	Edge of Canadian Shield	1985 (water)	79	
	Moorhead Univ.	Moorhead/Fargo area	Completed	NA	A few special requests
	Minnesota Power Co.	Northern Minnesota	Completed	NA	
Mississippi	Biloxi TV	Local homes	Fall 1986	240	
Missouri					
Montana	City of Great Falls	AT's to requests	Completed	25	Blank = No Program
	Nat'l Park Svc.	NPS buildings	Completed	NA	
	U.S. Forest Svc.	USFS buildings	Completed	250	
Nebraska	Omaha TV/newspaper	Small survey	Completed	NA	
Nevada					Free retests if >4 pCi/l or Cluster Identification Program homes
New Hampshire	Dartmouth College	Using state-owned WLM	In Progress	50	
New Jersey	Local Health Offices	Reduced rate CC programs	In Progress	NA	
New Mexico	NM Solar Energy Inst	Solar homes across state	Completed	20	A few special requests
New York	Several counties	Local measurements	Completed	NA	
North Carolina					Free to Reading Prong At cost w/energy audit
North Dakota	University group	Small study	Completed	NA	
Ohio	RAPCA and Channel 7	Dayton area, CC	Spring 1987	10000	
	Channel 8	Cleveland area, CC	Summer 1986	82	
	Akron RAQMD & Mont. RAPCA	District surveys	NA	NA	A few special requests
Oklahoma	Tulsa City County	Local	Winter 1986	42	
Oregon	Pacific Power & Light	Homes in weatheriz. prog	Completed	500	
	BPA (DOE)	Weatherization prog homes	In Progress	5000	
Pennsylvania					A few special requests
Rhode Island					
South Carolina					
South Dakota					
Tennessee					A few special requests
Texas					
Utah					
Vermont					
Virginia	Fairfax County	2400 tests planned	1987-1988	1200	A few special requests
Washington	BPA (DOE)	Weatherization prog homes	In Progress	14000	
West Virginia					
Wisconsin					
Wyoming	City of Lander	Local measurements	Completed	25	
TOTAL				35,472	

KEY

AT = alpha track
CC = charcoal canister
RPISU = radon progeny integrating sampling unit
WLM = Working Level Monitor

Completed =
Exact date
Unknown
NA = Not Available

Blank = No Program

Table 7
STATE ACTIVITIES ASSOCIATED
WITH MEASUREMENT

STATE	PROGRAM FOR MONITORING AND FOLLOW-UP		COMPUTERIZED DATABASE OF MEASUREMENT RESULTS			COLLECTION OF PRIVATE MEASUREMENT DATA BY STATE		
	Action or Recommendation	Trigger Level (pCi/l)	Status of Database	Level of Detail in Database	Policy Regarding Data Release	Means of Collection	In Data- base?	Source of Data
Alabama	Technical info sent	8	Planned	City, Zip, St.	Not Confidential	Company sends	Yes	Ter, Pitt, other
Alaska						By request		Ter, Pitt, other
Arizona						Company sends		Ter, Pitt
Arkansas						Company sends		Pitt
California						Company sends		Ter
Colorado			Planned	Zip		Company sends	No	N\S
Connecticut	Test locale if 3 homes above	20	Planned		Not Confidential		No	N\S
Delaware	State retest by request	4	Operat'l	Sample #, Zip	Anonymous	Company sends	No	Pitt
Florida	May send devices (future)	N\S	Operat'l	County, Zip	Summary data	By request	No	Ter, Pitt
Georgia			Operat'l	County, Zip	Confidential		No	N\S
Hawaii								Ter
Idaho			Operat'l	Sample#, Twshp	Confidential	Company sends	Yes	N\S
Illinois	Visit site, WLM & grab	20	Operat'l	Address	Summary data	By Request	Yes	N\S
Indiana	Provide alpha track free	10	Operat'l	County, Zip	Summary data		No	N\S
	Visit site and advise	50						
Iowa	State retest by request	30						
Kansas	Free retest to survey homes	20	Planned	County, Zip	Confidential			Ter, Pitt, other
Kentucky	May retest (case basis)	20	Planned	NA	Summary data		No	N\S
Louisiana								Ter, Pitt
Maine	Technical info sent	4	Operat'l	Address	Summary data	Company sends	Yes	Ter, Pitt, other
Maryland	Visit site; test; advise	20-50				Company sends		N\S
Massachusetts	Retest with RPISU	20	Operat'l	Zip	Anonymous	Company sends	Yes	N\S
Michigan			Planned	Zip	Summary data	Company sends		N\S
Minnesota								
Mississippi								
Missouri								
Montana	State retest by request	20						
Nebraska								
Nevada								
New Hampshire			Operat'l	NA	NA	Company sends	Yes	Pitt
New Jersey	Free retest (2 char. can.)	4	Operat'l	By test	Summary only	Mandatory	Yes	All private
	Survey of locale (Clust. Prog.)	200			by law			
New Mexico	Free retest (alpha track)	4	Operat'l	Name, addr.	Summary data	Company sends		Ter
New York	Free retest (2 char. can.)	20	Developing	Zip or town	Summary data		No	N\S
	Survey of locale	200						
North Carolina			Operat'l	NA	Anonymous		Yes	N\S
North Dakota	Free retest (PERM or RPISU)	8	Operat'l	By home	Confidential		No	N\S
Ohio	May retest after mitig.	N\S	Developing	I.D. number	Not Conf.	By request	No	N\S
Oklahoma						Company sends	No	Pitt
Oregon								
Pennsylvania	Free retests (alpha track)	4-20	Operat'l	NA	Summary only	Mandatory	No	All private
	Visit site; retest	>20			by law			
Rhode Island			Operat'l	NA	Confidential		No	N\S
South Carolina	Free retests (char. can.)	4	Developing	NA	Not decided	By request		None yet.
South Dakota								
Tennessee			Operat'l	NA	Confidential		No	N\S
Texas						Company sends	No	Ter, Pitt
Utah			Developing	NA	Not decided			Ter
Vermont							Yes	N\S
Virginia	Free retest to survey homes	4	Operat'l	Location code	Access by FOIA	By request		Ter, Pitt
Washington			BPA data	Township	Anonymous	Company sends	No	N\S
West Virginia						Company sends		U of P
Wisconsin	Visit site; test after mit.	N\S	Developing	NA	Not decided	Company sends	No	N\S
Wyoming	Free retest to survey homes	4	Operat'l	NA	NA			Ter, Pitt, Other

Blank indicates no program.

Blank indicates no computerized data management.

Blank indicates private data not collected.

KEY
N\S = Not specified
NA = Not available
PERM = Passive Environmental Radon Monitor
RPISU = Radon Progeny Integrated Sampling Unit
Pitt = Univ. of Pittsburgh
Ter = Terradex (now Landauer)

SOURCE: Putnam, Hayes & Bartlett, Inc., August 28, 1987.

Minnesota, Ohio, and Oklahoma have been sponsored by universities, local governments, or TV stations. Six States with Formative Programs (Arizona, Indiana, Massachusetts, Minnesota, Missouri, and North Dakota) have applied to participate in EPA's State Radon Survey Program, and California, Iowa, and New Hampshire also plan State surveys in FY 88. The number of completed State sponsored tests ranges from a very few to no measurements (Arizona, California, Indiana, Massachusetts, Minnesota, New Hampshire, Oklahoma, Vermont, and West Virginia) to between 50 and 500 measurements (the remaining 15 States, except Idaho, which has completed 1,000 tests). Alaska provides detectors at cost (previously free); Delaware performs tests on request. Six States have or will provide free follow-up tests (Delaware, Massachusetts, New Mexico, North Dakota, South Carolina, and Wyoming), and Ohio has retested a few homes that were mitigated. Twelve of these States have or are in the process of developing computerized measurement databases.

Ten of the 14 Developing Programs (Level 3 States) are currently participating in the EPA State Radon Survey Program and, therefore, have statistically designed surveys underway and nearly complete (Alabama, Colorado, Connecticut, Kansas, Kentucky, Michigan, Rhode Island, Tennessee, Wisconsin, and Wyoming). In all cases, these surveys employ charcoal canisters. The surveys will include between 500 and 2,700 measurements, depending on the State.

In addition, a number of Level 3 States are conducting surveys independent of EPA. Connecticut is conducting a 4,000 home study this summer. Illinois has 2,000 tests complete in a 3,000 to 4,000 test random survey. Indiana has completed 1,000 non-random measurements of a planned 3,000 home program, and Virginia has tested 800 homes (Fairfax County, Virginia has tested 1,200 homes and plans to test 1,200 more). Maryland also plans a comprehensive State-wide survey. All but Kansas and Michigan have at least a limited follow-up program. Rhode Island provides detectors at cost; Indiana provides detectors free to participants in its survey.

The five Operational Programs (Level 4 States) generally have already completed an extensive amount of measurement, especially in the three Reading Prong States. All five States have measured over 2,000 homes. Maine has measured radon in water in 4,560 homes. Pennsylvania, with EPA assistance, has tested over 24,600 homes and has applied to participate in EPA's FY 88 State Radon Survey Program. All five States provide detectors free or at cost to some homeowners. The Reading Prong States also provide free follow-up tests, Florida plans a follow-up program, and Maine recommends a follow-up test. New Jersey and New York include special follow-up procedures at levels above 200 pCi/l (e.g., a local survey is performed). In New York and Pennsylvania a State official offers to visit the home if levels are above 20 pCi/l. All five States are developing computerized measurement databases. Reporting of private measurements to the State is mandatory in New Jersey and Pennsylvania, where public access to names and addresses is also prohibited through specific legislation.

In addition to the comments above regarding the four general levels of program development, the following observations can also be drawn from State programs, as illustrated in Tables 4, 5, 6, and 7:

- Overall, over 53,000 measurements have been taken by the States. A large number of these were completed with EPA assistance. Additionally, at the end of FY 87, nearly 12,000 measurements will have been completed as part of the EPA State Radon Survey Program. EPA also assists States in other measurement activities. Over 86 percent of the state-sponsored measurements are in Level 4 States, about eight percent are in Level 3 States, and about six percent are in Level 2 States. None were in Level 1 States.
- Local governments or private sponsors have completed over 16,000 measurements (10,000 in Ohio by Dayton Channel 7), and BPA has sponsored nearly 20,000 tests as part of its weatherization program. Twenty States have had limited measurements

sponsored by counties, cities, local TV stations, newspapers, or academic institutions. In six cases, these measurements entailed surveys ranging in size from 50 to 600 measurements and, in one case (Fairfax County, Virginia), a survey of 2,400 homes is underway.

- Nineteen States have a measurement follow-up program in place which includes free retesting and/or a site visit. The measurement level that triggers follow-up testing varies fairly widely, probably because it depends in part on the availability of resources in the State. For States that have a follow-up program including confirmatory testing, trigger levels range from 4 pCi/l (for Delaware, New Jersey, New Mexico, South Carolina, and Virginia) to 40 or 50 pCi/l (for Maryland and Montana).

MITIGATION ACTIVITIES

Mitigation activities are typically one of the last areas to develop in a State radon program and one of the most difficult to track. Over 50 homes have been privately mitigated in each of the five Operational Program States. Almost all of the publicly sponsored activity is confined to the three Reading Prong States, as illustrated in Table 8. All three are participating in EPA/ORP's House Evaluation Program (HEP, which provides free diagnosis and follow-up, 110 homes) and in EPA/ORD's Mitigation Demonstration Program (102 homes). New York and Pennsylvania have sponsored additional mitigation efforts (14 homes in New York; 150 in Pennsylvania). Over 612 private mitigations have occurred in New Jersey and Pennsylvania; the number in New York is unknown but is probably substantial. New Jersey and Pennsylvania both have low interest loan programs for mitigation assistance, and a financial assistance program has been proposed in New York. New Jersey has a program for demonstration of radon prevention in new homes (with EPA and NAHB). A three-home new home prevention project was previously conducted in Florida. Over 12

Table 8
MITIGATION ACTIVITIES

STATE	MITIGATION ACTIVITIES Homes Completed or Underway				LOW INTEREST LOANS BY STATE ?	MITIGATION TRAINING COURSES	
	EPA-ORD Spons. Mitigation Demo. Program	EPA-ORP Spons. House Eval. Program (HEP)	Other EPA and/or State Spons. Mitigation	Private Mitigation if known		No. of State Personnel that Attended an EPA Course	Other State-sponsored Training Courses or Workshops that Include Mitig. Training
Alabama						1	
Alaska				3		0	
Arizona				<10		2	
Arkansas				1		1	tape,EPA course;9 st.empl
California				<10		NA	
Colorado						3	
Connecticut						1	
Delaware						4	
Florida			3;new homes;1986	10-100		5	
Georgia				0		2	
Hawaii						0	
Idaho				4-10		3	
Illinois						1 course; many	3/87 2-day course; 412 attended
Indiana						4	
Iowa						3	
Kansas				<10		3	
Kentucky						1	
Louisiana						1	internal seminar; EPA format; 15 attended
Maine				>12 air;>40 water		1	
Maryland	20 planned			>24		3	
Massachusetts				10-50		3	
Michigan						2	
Minnesota			4 retrofitted	<10		2	
Mississippi						1	
Missouri						6	
Montana				15		NA	
Nebraska				1		<12	
Nevada						3	
New Hampshire						1	
New Jersey	44(with state)	15 Phase II	new;state/EPA/NAHB	>332	Yes	40	
New Mexico				<5		3	
New York	16	15 Phase II	14;state/Niag.Mhwk	Unknown; many	Proposed	50	developed the EPA course
North Carolina				3-10		3	
North Dakota				50-100		1	
Ohio		10 Phase II				2	
Oklahoma						17	
Oregon				<10		10	
Pennsylvania	42	80 Phase I	150;state mitig.	>280	Yes	20	
Rhode Island				a few water mit.		2	
South Carolina						1	
South Dakota						0	
Tennessee		10 Phase II				1	
Texas				1		1	
Utah				>1		0	
Vermont						1	
Virginia		10 Phase II		>50		3	
Washington				BPA Mitigation		0	5 workshops, FY87; 500 attended
West Virginia						1	
Wisconsin				4-5 est.		1	
Wyoming				<10		1	
TOTALS	122 homes	140 homes	164 mitigations; Over 3 new home prevention proj.	Over 801 air mit. and over 40 water mitigations		Over 223 state employees in 40 states	

KEY: Blank indicates zero or no program.
NA = unknown.

SOURCE: Putnam, Hayes & Bartlett, Inc., August 28, 1987.

air mitigations and 40 water mitigations have occurred in Maine, and between 10 and 100 private air mitigations have been performed in Florida.

Among the 14 Developing Programs, two States are participating in Phase II of the HEP program (Tennessee and Virginia, 10 homes each), and Maryland is participating in the Mitigation Demonstration Program (15 to 20 homes). Virginia reports that over 50 private mitigations have occurred, but very few States have any accurate means to estimate the number of private mitigation efforts that have been completed or are underway.

Among the Level 2 States, only Ohio is involved in mitigation, through its participation in Phase II of HEP (10 homes planned). Ohio also estimates that between 50 and 100 private mitigations have been conducted. There is no Level 1 mitigation activity.

Over 226 State employees in 40 States have been trained at EPA Mitigation Training courses (in all, about 1,000 have attended one of these 27 courses). Seven States also offer some sort of mitigation training (in four cases using the EPA format).

HEALTH RISK AND GEOLOGIC STUDIES

Two important areas of radon study include health risk studies and geologic evaluations. At the State level, the emphasis of these programs is generally on evaluating the link between known areas of high radon levels and lung cancer incidence through epidemiologic studies, or on evaluating geologic characteristics to assist in locating potential radon hot spots. State health risk and geologic study activities are summarized in Table 9.

Not surprisingly, most of the health risk effort is concentrated in the Operational Programs (Level 4 States), especially in the Reading Prong. Four of these five States (all except Florida) have some study underway. New Jersey and New York have both established cancer registries to track

Table 9
HEALTH RISK AND GEOLOGIC STUDIES

STATE	DESCRIPTION OF HEALTH RISK STUDIES		DESCRIPTION OF GEOLOGY/LAND EVALUATION STUDIES	
	State Sponsored	Other	State Sponsored	Other
Alabama	Review survey results		Review survey results	
Alaska			Review of maps	
Arizona			Analysis of geol. survey	
Arkansas				
California				
Colorado				
Connecticut		Yale Univ./ NURE data	Review survey results	
Delaware			Gamma readings and mapping data points	
Florida	Company radon data and cancer statistics. Maintains cancer registry.		Review of NURE maps	
Georgia			Measuring radon flux and radium in soils for pre- and post-mining conditions	All major state universities have related work in progress
Hawaii				
Idaho	Study on lung cancer patients and their living environments (Epidemiology Division (DHWW))			
Illinois				
Indiana	Review survey results			
Iowa				
Kansas			Studying radon-bearing rock	
Kentucky			Review survey results	
Louisiana				
Maine	Cancer-radon study by DHS, Univ. of Maine & Maine Medical Center		Spot gamma/alpha readings of outdoor air; detailed bedrock map	Univ. of Maine; extensive studies
Maryland			Review survey results	
Massachusetts				
Michigan				
Minnesota			Radon in water study	
Mississippi			Review prior soil surveys	
Missouri				
Montana				
Nebraska				
Nevada				
New Hampshire				
New Jersey	Epidemiological study (DOH) mandated by P.L. 1985, Ch. 408. Maintaining radon exposure registry.		Published map of radon potential	
New Mexico			Geologic study of Clinton, NJ (DEP);	
New York	Cancer/radon registry of homes above 20 pCi/l.		Geologic assess. for Cluster Ident. program (DEP)	UNM radon emanation study
North Carolina			Research on soil characteristics in 4 areas of state.	
North Dakota			Developed maps of radon potential	
Ohio				
Oklahoma				Soil sampling by OSU
Oregon				
Pennsylvania	Review lung cancer statistics (DOH).	Argonne National Lab: (1) lung cancer mortality vs. Rn exposure. (2) Smker vs. non-smker Rn risks in Reading Prong	Gamma radiation road surveys	U.S. DOE: Fly-overs to map areas w/potential radon emissions.
Rhode Island				
South Carolina	Two small surveys to compare cancer incidence w/radon.			
South Dakota				
Tennessee				
Texas				
Utah				
Vermont				
Virginia			Review existing fly-over data	
Washington			Extensive uranium survey several years ago	
West Virginia			Review of DOE data	
Wisconsin				
Wyoming			Mapping of hot spots, planning map for EPA/state survey.	

SOURCE: Putnam, Hayes & Bartlett, Inc., August 28, 1987.

future cancer incidence among homeowners who have lived in homes that have been found to contain high radon levels.

Outside of Level 4, little health risk study is underway. Four States have performed some study (Alabama, Indiana (Level 3) and Idaho and South Carolina (Level 2)). Universities in at least two States (Yale, in Connecticut, and South Dakota State) also have studies underway.

All five Level 4 States are also engaged in geologic studies. In addition, geologic studies by the University of Maine and several Florida universities have been completed or are in progress. Thirteen other States have or had some studies (not necessarily sponsored by the State), including seven Level 3 States (Alabama, Colorado, Connecticut, Kansas, Kentucky, Maryland, Virginia, and Wyoming) and six Level 2 States (Alaska, Arizona, Delaware, Minnesota, New Hampshire, New Mexico, North Dakota, and Washington).

PUBLIC INFORMATION ACTIVITIES

Public information programs are generally among the first activities to begin within a State. All States have either utilized the information pamphlets developed by EPA for homeowner use ("A Citizen's Guide" and "Radon Reduction Methods"), have developed informational brochures themselves, or both. In total, EPA has distributed over 280,000 copies of "A Citizen's Guide" and over 150,000 copies of "Radon Reduction Methods" to States, public and private organizations and individuals. Many States have reprinted the pamphlets for wider distribution. In many cases, information programs have accelerated in response to media activities which raise homeowner awareness of a potential problem. Most States also will send the list of measurement companies participating in EPA's Radon Measurement Proficiency (RMP) program (or an extract or modified version) in response to homeowner requests for measurement company referrals.

All seven Information Programs (Level 1 States) are distributing the two EPA pamphlets on request, although generally 100 or fewer copies have been requested (except Texas, 400 of each). Only South Dakota has distributed EPA's "Technical Guidance." None of these States has developed its own materials, and eight or fewer calls are received per month (except South Dakota, which receives about 16, and Texas, which receives 30). All of these States will also send the EPA RMP list or an extract. None have toll-free "hot lines." No mitigation company referrals are provided (and they are very rarely requested).

The 24 States at the Formative Program level of development (Level 2) also distribute on request both EPA pamphlets and the RMP list or an extract, with four exceptions. These exceptions include California, Minnesota, and Utah, which do not distribute one or both of the two EPA pamphlets. Minnesota and Utah have distributed State developed materials in lieu of "A Citizen's Guide" and California is developing its own materials in lieu of both EPA pamphlets. The fourth exception, Delaware, distributes a State list in lieu of the RMP list, but does distribute the EPA pamphlets. Level 2 States that distribute the EPA materials have sent over 100 copies of one or both pamphlets, except for West Virginia (less than 20 copies of each). Nine States have distributed State-developed materials (Alaska, Massachusetts, Minnesota, Nebraska, North Carolina, North Dakota, Ohio, Utah, and Vermont). One Level 2 State has a toll-free hot line (Minnesota). California and Oklahoma are developing State materials. Mitigation company referrals are very limited (Delaware, Indiana, and Ohio list only one or two companies, North Dakota only lists heat exchanger companies, Utah lists only consulting companies, and Vermont is developing a list), although requests for referrals are also rare.

Seven of the 14 States with Developing Programs (Level 3) have sent or will send out State developed materials and all send "A Citizen's Guide" and "Radon Reduction Methods." State developed materials currently include questionnaires, special brochures for realtors, brochures focusing on radon in water, and others. These States generally will also provide the

EPA "Technical Guidance" on request, and four refer homeowners to specific radon mitigation contractors. All but three have distributed 1,000 or more copies of the EPA pamphlets. Typically, States stress that company referrals do not constitute endorsement or recommendation. Two have toll-free hot lines (Maryland and Virginia).

The five Operational Programs (Level 4 States) all have extensive information programs. All have distributed 10,000 or more of each EPA pamphlet. All have also distributed State developed materials. The three Reading Prong States have toll-free hot lines. All provide some sort of mitigation company referral. All provide an EPA or State list of measurement companies (Maine offers to test). All receive 260 or more calls per month (the three Reading Prong States each receive over 3,000 calls per month).

Table 10 summarizes all 50 State programs with respect to public information services. From Table 10 (and back-up information in Appendix A), the following additional observations can be made:

- EPA has distributed 280,000 copies of "A Citizen's Guide", 130,000 directly to the States and 150,000 to organizations and interested citizens. Twenty-four States have distributed 1,000 or more copies of "A Citizen's Guide," 12 have sent over 10,000, and one over 100,000 (Pennsylvania). It is estimated that States have distributed approximately 330,000 copies of "A Citizen's Guide".
- Forty-seven States send out "A Citizen's Guide," and the remaining three have sent or will send modified versions (California, Minnesota, and Utah).
- The States have distributed nearly 280,000 copies of "Radon Reduction Methods". Over 60 percent were distributed by Level 4 States. Twenty-one States have sent out 1,000 or more copies of "Radon Reduction Methods," nine have sent over 10,000, and one has sent over 100,000 (Pennsylvania).

Table 10
INFORMATION ACTIVITIES

STATE	EPA MATERIALS SENT OUT			STATE MATERIALS DISTRIBUTED		TELEPHONE INQUIRIES		MEASUREMENT COMPANY REFERRALS	MITIGATION COMPANY REFERRALS
	A Citizen's Guide to Radon	Radon Reduction Methods: A Home-owner's Guide	Radon Mitigation Technical Guidance	Yes/No	No. copies sent	Toll Free ?	Avg. Calls Per Month		
Alabama	4,500	4,500	200	Y	1,900		25	Extract from RMP list	
Alaska	100	25		Y	NA		20	RMP list	
Arizona	2,000	2,000	<20	N			140	Extract from RMP list	State and EPA List
Arkansas	100	100		N			4	RMP list	
California	0	0		Developing			40	Extract from RMP list	
Colorado	2,000	1,000	200	Y	NA		200	State list w/RMP co.'s marked	Send list from EPA-Denver
Connecticut	10,000	10,000	NA	Y	10,000		NA	Extract from RMP list	List of five EPA contractors
Delaware	>250	>250	6	N			NA	List of state registered co.'s	2 Firms;attended EPA train.
Florida	50,000	30,000	1,500	Y	500		260	RMP list & Florida firms	State list
Georgia	300	<100		N			40	Extract from RMP list	
Hawaii	<5	<5		N			<2	RMP list	
Idaho	700	700		Developing			80	Extract from RMP list	
Illinois	18,000	18,000	300	N		Yes	>250	RMP list	
Indiana	2,000	2,000	300	Developing			NA	List w/primary RMP firms	
Iowa	175	175	6	N			25	RMP list	1 Firm;attended EPA train.
Kansas	1,500	100	2	Y	6		20	RMP list/state developing list	State developing list
Kentucky	2,000	500		N			NA	RMP list sent to counties	
Louisiana	25	25		N			8	Extract from RMP list	
Maine	10,000	6,000	40	Y	10,000		300	Verify co.'s particip. in RMP	4 co.s' referred over phone
Maryland	16,000	16,000	>100	Y		Yes	1400	Extract from RMP list	6 firms req. to be listed
Massachusetts	20,000	30		Y	>10,000		300	State list(select of RMP)	
Michigan	10,000	10,000	150	Y	NA		100	RMP AT & CC co.'s	
Minnesota	0	4,500		Y	4,500	Yes	40	Extract from RMP list	
Mississippi	50	50		N			6	RMP list	
Missouri	<200	<200		N			24	RMP list	
Montana	2,500	2,500	NA	N			120	Extract from RMP list	
Nebraska	500	500		Y	NA		30	RMP list	
Nevada	15	15		N			5	RMP list	
New Hampshire	10,000	10,000		N			200	RMP list	
New Jersey	25,000	25,000	3,000	Y	2,000	Yes	5000	State developed list	State developing list
New Mexico	>500	>500	NA	N			24	Extract from RMP list	
New York	15,000	12,500	300	Y	15,000	Yes	3500	RMP list + local NY firms	List of course attendees
North Carolina	1,000	1,000	20	Y	NA		NA	Extract from RMP list	
North Dakota	250	100		Y	NA		80	Extract from RMP list	
Ohio	10,000	10,000	200	Y	10,000		80	RMP list	
Oklahoma	500	500	10	Developing			25	RMP list	
Oregon	100	100		N			14	Extract from RMP list	Refer to BPA
Pennsylvania	100,000	100,000	1,000	Y	100,000	Yes	3000	State developed list	State developed list
Rhode Island	500	500		N			40	Extract from RMP list	
South Carolina	400	400		N			25	Extract from RMP list	
South Dakota	100	100	100	N			16	RMP list	
Tennessee	5,000	1,000	100	N			NA	RMP list	3 firms req. to be listed
Texas	400	400	10	N			30	RMP list	
Utah	0	50		Y	NA		16	2 firms by phone/ RMP list	List consulting firms only
Vermont	200	20	10	Y	200		40	Extract from RMP list	State developing list
Virginia	1,000	2,000	100	Y	10,000	Yes	140	RMP list	
Washington	5,000	5,000		Y	5,000		30	State list (
West Virginia	20	12		N			40	RMP list	
Wisconsin	300	150	3	N			NA	Extract from RMP list (3 co.)	
Wyoming	2,500	NA		Y	NA	Yes	50	RMP list	
TOTAL	330,685	278,602	7,677		179,106		15,537		

KEY NA = Not Available.
Blank = None unless

Developing = Indicates a list is
being developed by state.

Blank = No policy
for referral.

otherwise indicated.

SOURCE: Putnam, Hayes & Bartlett, Inc., August 28, 1987.

- Thirteen States have sent out 100 or more copies of EPA's "Technical Guidance."
- Eight States have toll-free hot lines. For all 50 States, nearly 16,000 calls are received per month. Four States are receiving over 1,000 calls a month (the Reading Prong States and Maryland).

ISSUES AND COMMENTS EXPRESSED BY STATES

Many of the State contacts made observations that, due to the nature of the comment, could not be included in the summary table structure. We believe that several of the issues or concerns raised may be useful in understanding the current status of State radon programs.

1. Several States mentioned a concern about "unscrupulous" companies performing poor measurements or offering unqualified mitigation services. Two States suggested that certification or guidelines to certify companies in radon-related work is an area where EPA could provide the most assistance. Most companies do not make any referrals for mitigation and only refer States on EPA's RMP Report for testing services. The States typically do not have the resources to determine which companies are qualified.
2. Several States indicated an interest in the EPA State Radon Survey Program, but are presently unable to devote the resources it requires. The EPA/State survey requires several State personnel for selection of test homes through a telephone survey, for distribution of the measurement devices, and for data collection and management. A State resource commitment of \$50,000 to \$100,000 is needed, depending on the State. EPA provides between \$75,000 and \$150,000 to each State participating in the program.

3. Thirty-one of 50 States are at the Information Program or Formative Program level of development. While almost all States are interested in developing their programs, most have found it difficult to obtain the necessary funding.
4. Although all States are concerned about radon, for many States it is not the primary environmental concern. The more established environmental issues and operational programs compete for State resources and public attention.

OVERALL OBSERVATIONS AND TRENDS

Over the last two years, State attention to indoor radon has increased substantially, in parallel with a broader public awareness and, through additional measurements, a growing body of data that continues to suggest that elevated radon levels could be widespread. For States with Formative or Developing programs, early action has often included creation of a task force to study the problem. A majority of the task forces or committees now advising States include interagency government members, legislators, representatives from private industry (realtors, housing contractors, mitigation contractors, measurement firms) academia, and even private homeowners. These committees have provided valuable input and are expected to be important for consensus building, public information, public acceptance of radon initiatives, and public confidence that the issue in the State is being properly addressed.

Since most States are developing or just beginning to develop radon programs, measurement activities constitute one of the key activities among the States. The undertaking of a widespread radon survey, which is almost always necessary to determine the true extent of the problem in the State, is the primary distinction between Formative and Developing programs. However, since 19 of 50 States have conducted or will shortly complete wide-scale measurements, knowledge of the technical, resource, and organizational requirements of such surveys is fairly well advanced.

Obviously, future trends in State radon programs depend on whether a radon problem is discovered in the State, and, if one is discovered, its severity. Initial survey results have indicated that many homes have radon levels above 4 pCi/l. While these surveys are not necessarily indicative of radon levels nationwide (since, for example, many of the surveys targeted areas known or suspected to have elevated levels), they do suggest that indoor radon may be a problem in virtually every State. As knowledge of the problem evolves, a number of issues that have not yet received a great deal of attention are likely to grow in importance. Such issues include: predictive measurement techniques, mitigation in homes with high or moderate radon levels, health risk estimates, various regulatory or legal issues (certification, liability, and confidentiality), and radon prevention in new homes.

Even if a survey indicates that a widespread problem exists, identification of exactly which houses have elevated levels is necessary before mitigation can begin. For States where only a small number of homes are expected to have elevated levels, measuring all the homes in the State would be fairly expensive. However, as geologic studies and work on new measurement techniques (e.g. soil gas testing) continue, the ability to predict high radon areas should improve. By avoiding measurements in unlikely areas, such prediction should decrease the cost of identifying homes with elevated levels.

Mitigation activities -- "fixing" the problem once it is located -- have significant technical, organizational, and resource-related questions still outstanding. Since mitigation is much more costly than testing, resource-related questions will be very important. Even Operational radon programs are just beginning to tackle these problems. Since measurements, once underway, can be completed fairly quickly (observe that very few measurements were taken prior to 1985), but mitigation is likely to proceed fairly slowly (due to outstanding technical questions and relatively greater resource requirements), it is possible to anticipate that mitigation will soon be a central issue.

State administrators that have already encountered high radon levels have frequently recommended mitigation of homes with radon levels over 20 pCi/l when this level has been confirmed with long-term living-level measurements. However, the much larger number of homes likely to be in the 4 to 20 pCi/l range which are subject to various interpretations. The tendency at these levels has been for State radon administrators to offer insight and information on the personal risk of the readings (given specific life styles) and to leave the mitigation decision in the homeowner's hands.

Relative to many other environmental health risks, the risk of exposure to radon is relatively well understood. However, substantial uncertainty still remains. Two States (New Jersey and New York) have begun to collect data that will help to improve our knowledge of radon risks. In both States, a registry has been established that will track the cancer incidence prospectively among homeowners who have lived in homes recently found to have elevated radon levels. Addition of radon exposure data (when available) to existing cancer registries in other States represents a potential extension of this health risk data collection effort.

Actions dealing with the certification of mitigation and measurement companies are likely to increase; however, mandatory certification may often require new legislative authority. Nebraska and New Jersey are particularly proactive in this area. Nebraska will soon require that a mitigation proposal that is offered by a mitigation contractor to a homeowner be provided to the State before any mitigation can be conducted. The contractor will also pay a fee to be included on a list of certified mitigation companies which the State will provide to homeowners. Thus, the administration of the program by the State will, in part, be funded by these fees.

Difficult legal questions concerning confidentiality and liability, especially in the context of property transfers remain largely unanswered. Should a homeowner who has tested his property be required to inform prospective buyers? Should a homeowner who has mitigated be required to inform prospective buyers (to ensure that the remediation is not

accidentally defeated)? If the State has a measurement for a home in its database, should it release this data to prospective buyers? Might this data become a form of evidence in litigation resulting from buyer/seller disagreements? If a test is conducted before transfer of real property, how should the results be interpreted? How can the quality of this type of test be ensured (closed conditions, season, etc.)? Answers to these questions will be difficult; however, as measurement and mitigation activity increases, their importance is likely to grow. To date, two States (New Jersey and Pennsylvania) have passed legislation which maintains the confidentiality of measurements reported to the State.

Finally, prevention of elevated radon levels in new homes represents yet another area where future activity is likely to grow. To date, only two States have addressed this problem in earnest: Florida, since the late 1970's, and New Jersey, relatively recently (with EPA and NAHB). Study issues include changes to building codes, development of radon "resistant" construction techniques, and soil gas radon measurement.

